WASHINGTON
SCIENCE TRENDS

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Vol. V, No. 17 January 9, 1961

SPECIAL NOTICE: The Federal Government Budget for Fiscal 1962 will be released Monday, Jan. 16. Washington SCIENCE TRENDS will bring its readers an extensive review and analysis of the new Budget as it will effect research and development and military procurement. This popular annual survey had to be reprinted three times last year to meet reader demand. Extra copies will be available at $1. For prompt service, order today. Send instructions to Service Department, Washington SCIENCE TRENDS, National Press Bldg., Washington 4, D. C.

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* THERMOELECTRIC POWER DEVELOPMENT

The U. S. Naval Research Laboratory, Washington 25, D. C. sees three important new application possibilities for thermoelectric power units. These are:

✓ Nuclear Heating -- Insertion of thermocouples directly into the core of a nuclear reactor could reduce size and complexity of a power system. Early reports indicate that there is essentially no high energy radiation deterioration in the useful properties of thermocouples in installations now planned -- locating around the periphery of the reactor. Studies also show it is now possible to consider in-pile operation.

✓ Space Power -- Feasibility of using thermocouples in a flat plate arrangement has been indicated by a proprietary industry study, said to show that a solar-heated thermoelectric system would be very much lighter and cheaper than a solar cell array although it occupies a larger volume.

✓ Ship Propulsion -- Still several steps removed "but the steps appear to be getting shorter." This NRL opinion is based on information gained through a 5KW Westinghouse thermoelectric generator, and other recent experiences with hardware.

Problems -- Early overoptimism may have damaged the thermoelectric program, according to the Navy. Now, however, early predictions are beginning to be met and exceeded experimentally. Problems still to be solved include reduction of the size of low resistance contacts which in turn determine the size and weight of heat exchanger, diffusion of doping agents and electrode materials which sets their life, and improving mechanical properties of frequently brittle thermoelectric materials. But the Navy researchers warn:

"Unfortunately, there is no immediate prospect for initiating these studies. A request for funds for this work which was initially encouraged and technically endorsed was ultimately refused for policy reasons. It does not appear wise to move ahead rapidly on devices without the necessary supporting research on materials. The availability of quiet, maintenance-free power supplies for space, for ship propulsion, ASW or any other application has therefore been set back a substantial amount of time."

("Status Report on Thermoelectricity", Naval Research Laboratory Memorandum Report No. 1089, is now available through military channels or at $1.75 from OTS, U. S. Department of Commerce, Washington 25, D. C.)

* PROJECT BANSHEE

The Federal Aviation Agency (FAA) holds hearings this week on plans to detonate 500 pounds of pentolite high explosive at altitudes of up to 125,000 feet over White Sands Missile Range, New Mexico, this June. The project is part of Project Banshee (SCIENCE TRENDS, June 13, 1960) to determine the hydrodynamic effects produced by explosions at high altitudes of burst.

Banshee is sponsored by the Defense Atomic Support Agency (DASA) in cooperation with the Ballistic Research Laboratories, Aberdeen Proving Ground, Md.; Naval Ordnance Laboratory, White Oak, Silver Spring, Md.; Air Force Cambridge Research Center, Mass. and White Sands.

The initial explosive packages will be carried by 300-foot, 5-million cubic foot balloons, elaborately instrumented to provide basic information on blast phenomena and energy partitioning at high altitudes, while providing an insight into the effects of high altitude nuclear detonations.

Should FAA approve, Phase I tests will be carried out, with balloon-carried charges. If these experiments are encouraging Phase II tests will begin, with the charge carried aloft by a Nike-Hercules missile and detonated in the immediate vicinity of balloon-carried instrumentation. Blast pressure, arrival time, acceleration and possible thermal measurements will be made. The experiments would presumably be of value in anti-satellite and anti-ICBM programs.

* MARITIME RESEARCH PROGRAM

The U. S. Maritime Administration, Washington 25, D. C. is negotiating 12-month, $50,000 contracts with four leading universities for long-range ship research programs. In addition, each institution will be asked to prepare research programs for the five-year period of 1962-66.

Areas to be studied include:

✓ Research and Propulsion -- The University of Michigan will study the reduction of powerplant weight and cost by reduction in power requirements, particularly in ships of advanced type. This will entail model tests and theoretical work to develop unusual hull forms and possibly new hull coatings to reduce resistance; consideration of future ship types; possible new thrust producing devices; development of cheaper and more accurate model test techniques and research to increase the limit of power which can be installed on a single shaft.

✓ Seagoing Qualities -- Massachusetts Institute of Technology will study means of reducing rough weather delays at sea in order to permit sailing schedules to be maintained, even with shorter port turnaround time and higher design speeds. Model test programs to develop improved hull design and special devices to reduce ship motions and permit higher rough weather speeds will be carried out. Systematic sea observations will also be made.

✓ Control and Maneuvering Research -- Stevens Institute of Technology will study means of making ships more amenable to mechanized control. Basic hydrodynamic knowledge will be sought, as well as better steering gears and control systems. Attention will be given to more reliable methods of predicting ship performance and rudder torque in the design stage.

✓ Ship Structures -- The University of California will study possible reduction of hull steel weight, construction costs and damage repair costs by developing more efficient structural designs. One major problem is the design of hulls having most of the deck cut away for container storage -- a question which must be solved if container-type ships are to be economically designed.

* ERRORS IN ALTIMETER READINGS

Field experiments by the National Aeronautics and Space Administration with 196 military and civil aircraft indicate that during 50 percent of all landings altimeters will have an error of ± 36 feet. In 3 landings out of 1000, the error can be as large as ± 159 feet. Military altimeters were less reliable, registering an error of 43 feet at least half of the time, and 189 feet in 3 cases out of 1000. For civil airliners, these errors were 22 feet and 96 feet, respectively.

✓ Continued work needed -- NASA has been advised by the Federal Aviation Agency, military authorities and commercial operators that the experiments show the need for continued work to improve altimeter accuracy during landings, although current installations are said to provide an adequate safety margin. Most airfields have a minimum ceiling of about 200 feet and minimum visibility of .5 miles for instrument landings.

✓ Cause of errors -- The NASA studies indicate that the overall errors in altimeter readings result from three individual system errors. These are: errors in the instrument, errors in the static pressure supplied to the pilot from the ground, and errors arising from installation such as the location and condition of static pressure ports and the pressure tubing arrangement. Maintenance of the altimeter system is said to have as much effect on the overall error as the original design. Better performance in this area is being pushed by both the military and the airlines.

(For details on low-level altimeter tests write the National Aeronautics and Space Administration, Washington 25, D. C., ATTN: Code BID, requesting Technical Note D-463)

* SCIENCE AND SECRETARIES

Studies recently published indicate that in the scientific race with the Soviet Union, one good secretary is worth at least two good scientists. According to these observations:

"It is axiomatic that a lab can produce only as fast as its secretary can type. The lab with one scientist and four secretaries is in a more favorable position than the lab with four scientists and one secretary.

"In the latter case, the scientist will spend most of his day peering over the secretary's shoulder seeing whether she is showing favoritism to his three colleagues. There will be intrigues and quarrels to get letters typed, income tax forms filled out and lead pencils requisitioned. Realistically, there is no motivation for the scientist to write if there is no one to type for him.

"In the lab with one scientist and four secretaries, our man is in a constant turmoil to keep his assistants busy. He feels he must produce so that his harem looks busy. If they start bringing in knitting and learning bridge, his superiors will become suspicious."

The studies have led to the development of the following law for the scientific output of any research laboratory;

$$\text{Productivity} = \frac{\text{Number of secretaries} \times \text{average typing speed}}{\text{Number of scientists}}$$

It is pointed out that one interesting feature of this equation is that when the number of scientists becomes zero, productivity becomes infinite.

(Studies by R. Sommer, Weyburn, Canada published by Planaria Research Group, University of Michigan, Ann Arbor, Mich.)

RESEARCH REQUIREMENTS

Here is a new listing of U. S. Government research and development requirements. Subscribers interested in these technical problems may write Service Department, Washington SCIENCE TRENDS, National Press Building, Washington 4, D. C. You will be furnished with the official problem number, and information on which office or agency can provide details.

- RADIO INTERFERENCE METER: Interest is expressed in a sturdy, accurate go/no-go type of meter to automatically detect radio interference from vehicles and other portable equipment entering communications and other sensivite electronic areas. Existing meters are said to have deficiencies including unreliability at the minimum triggering level, spurious response rejection and inadequate dynamic range. The meter would have to operate without the presence of an electronic technician, in the 14KC to 1000 mc spectrum.

- ANTENNA PROTECTION: The Navy has found that stack exhaust gases settle on antennas and coat them with acid. Present protective coatings crack easily, and are short-lived. New materials for fabricating antennas or a coating compound are required. Both must provide protection in the presence of sunlight.

- ELECTRIC MOTORS: Despite extensive use of lightweight materials most D. C. motors and drives are heavy and bulky. A small, lightweight A. C. electric generator and drive motor for wheel drive vehicles may prove more satisfactory since phase control would permit the elimination of heavy reduction gearing.

- RANDOM ACCESS STORAGE DEVICES: These modular devices for use in the Army's Fieldata family of equipments are said to be urgently required to replace slow serial stage of magnetic tape. The requirements appear in applications requiring large volume of data with frequent access.

- GERMICIDAL GREASES AND OILS: Germ warfare equipment often requires lubrication, or involves hydraulic systems requiring a suitable working fluid. Both can become contaminated with infectious agents. It is believed that self-sterilizing lubricants and hydraulic fluids would relieve the necessity for special decontamination, disassembly and lubrication procedures.

- AERIAL TERRAIN MEASUREMENTS: Aerial photography is currently used for analysis of relief, soil type, strength, density and moisture content of terrain. However, results are mainly qualitative and require study by experts. It is believed that various electromagnetic means such as radar or infrared offer possibilities which have not yet been fully exploited.

- IMPROVED IMAGE INTENSIFICATION: Many operations would be expedited if lookouts on surfaced submarines could see further through light haze and fog and in areas of universally bright light where small contrast differences must be detected. Radar or active sonar may not be desirable; passive optical systems alone must be used to warn of approaching enemy forces. The use of light amplification techniques seems promising, but significant improvements are needed.

RESEARCH CHECKLIST

□ LUBRICANTS FOR HIGH TEMPERATURE GLASS BEARINGS: Halogen-containing gases have been studied by the National Aeronautics and Space Administration as lubricants for Pyroceram 9608 (a crystallized glass ceramic) bearings for nickel- and cobalt-base alloy shafts at temperatures from 75° to 1500°F. Results of the tests indicate that the glass bearings and gaseous lubricants were satisfactory from 75° to 1200°F and at sliding velocities up to 6400 feet per second. Above 1200°F, the friction coefficient and wear of the bearings increased rapidly. The Pyroceram material used by the NASA experimenters last summer was one of the first commercial formulations of crystallized glass ceramics. It is believed that subsequent formulations will have much better high temperature mechanical properties and that the halogen-containing gaseous lubricants will prove adequate.

(NASA Technical Note D-295, entitled "Halogen-containing Gases as Lubricants for Crystallized-Glass-Ceramic-Metal Combinations at Temperatures to 1500°F", available by writing National Aeronautics and Space Administration, Washington 25, D. C., ATTN: Code BID)

□ EFFECT OF TITANIUM IMPURITIES: Studies to show the effects of impurities in titanium refined by three different methods have been conducted by the Bureau of Mines. The three titanium producing methods are electro-refining, sodium-reducing and magnesium reducing. The effects of impurities were determined by comparing the physical behavior, including workability, recrystallization characteristics and mechanical properties.

(Results of these experiments are contained in the report entitled, "Characteristics of Cold-rolled and Annealed Titanium" available from Publications-Distribution Section, U. S. Bureau of Mines, 4800 Forbes Avenue, Pittsburgh 13, Pa.)

□ ELECTRONIC BONDING MATERIALS: Studies sponsored by the U. S. Air Force have led to the development of gallium alloys for the low-temperature bonding of wires to heat-sensitive electronic devices. Originally studied for use in dental restorations, it was found that these alloys can resist temperatures as high as 900°C for use with such devices as transistors, and can be used to "cold solder" ceramic and metallic surfaces.

(Details available. Single Copies Free. Write National Bureau of Standards, Office of Technical Information, Washington 25, D. C. for Summary Technical Report "Gallium Alloys for Low-Temperature Bonding."

□ ULTRASONIC CAVITATION: The National Bureau of Standards, with Navy support, has developed an ultrasonic source to create cavitation bubbles -- holes in the form of bubbles -- in the interior of a mass of water. The source is a cylinder of barium titanate containing the water. According to the Bureau, the matching of the resonant frequencies of the cylinder and of the water created tensile stresses great enough to open up cavitation bubbles away from the walls -- making it possible to measure conveniently the tensile strength of water and other liquids.

□ REGENERATIVE COOLING WITH NITROGEN TETROXIDE: Recent experiments in the U. S. have shown that nitrogen tetroxide, one of the most promising of the storable oxidizers for rocket engines, will have limited usefulness as a regenerative coolant for the nozzle and combustion chamber. Work at the Jet Propulsion Laboratory, Pasadena, Calif. appears to indicate that liquid nitrogen tetroxide can be used as a regenerative coolant only in rocket engines where maximum local heat flux and the total heat load are low.

PUBLICATION CHECKLIST

- ☐ SMALL PLANT R&D MANAGEMENT, a brief Government guide "designed to help managers and owners of small plants understand better the administrative side of technology as a stepping stone toward increased business and better profits." 4 Pages. Single Copies Free. (Write Service Department, Washington SCIENCE TRENDS, 1120 National Press Building, Washington 4, D. C.)

- ☐ CONCRETE RADIATION SHIELDING, an informative 1960 literature survey prepared by the U. S. Naval Civil Engineering Laboratory, Port Hueneme, Calif. on the protective shielding properties of concrete against nuclear radiation. 28 Pages. 75 Cents. (Write OTS, U. S. Department of Commerce, Washington 25, D. C. for PB 161 910)

- ☐ OCEAN-WIDE SURVEYS, another chapter of a continuing report on the many phases of oceanography to be investigated during the 1960's. This chapter deals with the world-wide, ocean-deep surveys required to map the world's ocean basins. 22 Pages. Single Copies Free. (Write Information Office, National Academy of Sciences, 2101 Constitution Avenue, N. W., Washington 25, D. C.)

- ☐ FERROMAGNETIC FILMS, a Remington Rand Univac Division report for the Air Force on the results of an experimental study of the magnetic properties of thin films prepared by chemical methods. "Encouraging results" are reported. Report dated May, 1960 now available. 39 Pages. $3 in microfilm, $6.30 in photocopy. (Write Library of Congress, Photoduplication Service, Washington 25, D. C. for Report AFCRC-TN-60-572)

- ☐ FILM DISTORTION COMPENSATION, a technical study of tests made with new plastic aerial film for photogrammetric use, and means devised for coping with film distortion. 5 Pages. 10 Cents. (Write Superintendent of Documents, Government Printing Office, Washington 25, D. C. for U. S. Coast and Geodetic Survey Technical Bulletin No. 14)

- ☐ HELICOPTER TRANSPORT SERVICE, a Federal Aviation Agency report on the future of the helicopter and other vertical and short take-off and landing aircraft in short-haul commercial use. Single Copies Free. (Write Office of Plans, Federal Aviation Agency, Washington 25, D. C. for "Project Hummingbird Report.")

- ☐ NUCLIDES, a technical report on the calibration of five gamma-emitting nuclides for emission rate. Covers Mercury-203, Strontium-85, Niobium-95, Zinc-65 and Sodium-22. 20 Pages. 75 Cents. (Write OTS, U. S. Department of Commerce, Washington 25, D. C. for NBS Technical Note 71.)

- ☐ REINFORCED PLASTIC LAMINATES, a Defense Department handbook containing general design criteria for flight applications. Fundamental mechanical properties of a number of parallel laminates, data on fatigue strength and creep are among the topics covered. 179 Pages. $1.50. (Write Superintendent of Documents, Government Printing Office, Washington 25, D. C. for Publication D 7.6/2:17 pt.1)

- ☐ ENGINEERING DRAWINGS, a military standard which establishes the sizes and minimum format requirements for the preparation of engineering drawings in Defense Department programs. 14 Pages. 20 Cents. (Write Superintendent of Documents, Government Printing Office, Washington 25, D. C. for Publication D 7.10:2B)

Research and Development Directory

* ATOMIC ENERGY COMMISSION

Basic research is performed for the most part by universities and other non-profit research organizations on the basis of proposals submitted to and contracts approved by AEC in Washington and executed by the various AEC operations offices. Those interested in contracts for basic research may obtain "A Guide for Submission of Research Proposals" by contacting the Division of Research regarding the physical sciences, the Division of Biology and Medicine regarding the life sciences, and the Division of Reactor Development, Atomic Energy Commission, Washington 25, D. C.

Applied Research and Development are performed to a limited extent by private concerns in their own facilities pursuant to contracts and subcontracts with the various AEC operations offices and cost contractors. Most of this type of work is performed by the cost contractors that operate AEC research laboratories, and other research facilities. Those interested in this activity should contact the AEC operations offices.

Directory of Purchasing Offices for Research and Development:

WASHINGTON HEADQUARTERS:
U. S. Atomic Energy Commission
Washington 25, D. C.

Director, Division of Research:
J. H. Williams
Small Business Advisor: Phillip Reid
Director, Division of Reactor Development:
F. K. Pittman
Director, Division of Biology and
Medicine: C. L. Dunham, M.D.

ALBUQUERQUE OPERATIONS OFFICE:
U. S. Atomic Energy Commission
H Street at Pennsylvania
Sandia Base - P. O. Box 5400
Albuquerque, N. Mex.

K. F. Hertford, Manager

Interests - Research, development, production, and testing in the field of atomic weapons.

CHICAGO OPERATIONS OFFICE:
U. S. Atomic Energy Commission
P. O. Box 59
Lemont, Ill.

K. A. Dunbar, Manager

Interests - Research and development programs and incidental engineering and construction; also programs involving fundamental research and the training of younger scientists. It gives particular attention to chemical and metallurgical problems such as the development of processes for the production of rare metals and the preparation of crucible materials for the melting and casting of metals.

LOCKLAND AIRCRAFT REACTORS OPERATIONS OFFICE: Harry H. Gorman, Area Manager
U. S. Atomic Energy Commission
P. O. Box 23, Lockland Branch
Cincinnati 15, Ohio

Interests - Concerned with research, design and development work on nuclear reactors for aircraft propulsion.

NEW YORK OPERATIONS OFFICE:
U. S. Atomic Energy Commission
70 Columbus Avenue
New York 23, N. Y.

Joseph Clark, Manager

Interests - Administrative responsibility for broad programs of research and development.

DIRECTORY OF PURCHASING OFFICES FOR RESEARCH AND DEVELOPMENT (continued)

OAK RIDGE OPERATIONS OFFICE: S. R. Sapirie, Manager
U. S. Atomic Energy Commission
P. O. Box E
Oak Ridge, Tenn.

Interests - Programs of research and development and community operations.

PITTSBURGH NAVAL REACTORS OPERATIONS OFFICE: L. D. Geiger, Manager
U. S. Atomic Energy Commission
P. O. Box 1105
Pittsburgh 30, Pa.

Interests - Research and development on reactors for the propulsion of naval vessels, including submarines and surface ships.

SAN FRANCISCO OPERATIONS OFFICE: Ellison C. Shute, Manager
U. S. Atomic Energy Commission
518 17th Street
Oakland 12, Calif.

Interests - Research and development in a variety of scientific fields with primary emphasis on reactors, accelerators, and testing in the field of atomic weapons.

SCHENECTADY OPERATIONS OFFICE: Stanley Nitzman, Manager
U. S. Atomic Energy Commission
P. O. Box 1069
Schenectady, N. Y.

Interests - Research, development, and design programs on nuclear reactor power plants for the propulsion of naval vessels and on the development of related equipment.

NATIONAL BUREAU OF STANDARDS - DEPARTMENT OF COMMERCE

This federal agency conducts research in the following fields: physics, engineering, chemistry, the Boulder Laboratories. A major portion of its work is done for other government agencies. Most of it is in-house research and consists of testing, and the maintenance of standards.

PHYSICS

Electricity and electronics, optics and metrology, heat, atomic and radiation physics, applied mathematics, data processing systems, basic instrumentation.

ENGINEERING

Mechanics, building technology, weights and measures.

CHEMISTRY

Chemistry, organic and fibrous materials, metallurgy, mineral products.

BOULDER (COLORADO) LABORATORIES

Operated in conjunction with the University of Colorado. Cryogenic engineering, radio propagation physics and engineering, radio standards.

The point of contact is:

Associate Director for Planning
National Bureau of Standards
Connecticut Avenue and Van Ness Street
Washington 25, D. C.